A1250-1
5/31/88

MAY 30, 1988

CHEMICAL & ENGINEERING

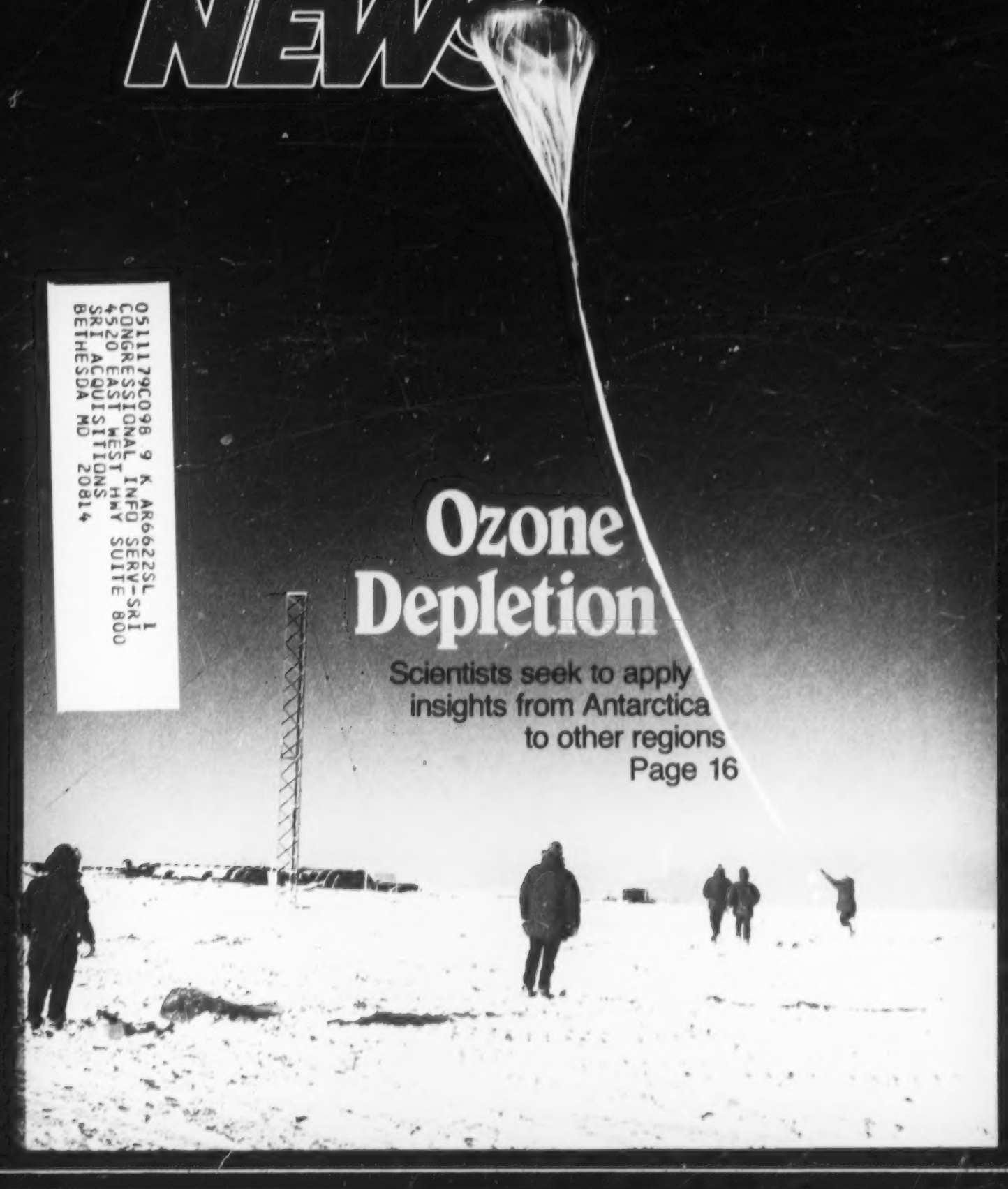
NEWS

05111179C098 9 K AR6622SL 1
CONGRESSIONAL INFO SERV-SRI
4520 EAST WEST HWY SUITE 800
SRI ACQUISITIONS
BETHESDA MD 20814

Ozone Depletion

Scientists seek to apply insights from Antarctica to other regions

Page 16



CHEMICAL & ENGINEERING NEWS

Volume 66, Number 22
CENEAR 66 (22) 1–52
ISSN 0009-2347

MAY 30, 1988

News of the Week

■ **Expanded cooperation in science and technology is expected to come out of the U.S.-Soviet summit this week in Moscow.** **Page 4**

■ **Italy's two largest chemical firms—Montedison and EniChem—are moving toward linking their chemical businesses.** **Page 5**

■ **UCLA's Richard B. Bernstein is the 1988 recipient of the Robert A. Welch Award in Chemistry.** **Page 5**

■ **The Patent Office's efforts to fully automate have been strongly rapped by an industry panel and Commerce is acting to implement panel recommendations.** **Page 5**

■ **Special luncheon held last week to hear the science views of the major Presidential candidates drew a tepid response.** **Page 6**

■ **Argonne National Laboratory's electrorefining process is key step toward development of a nuclear reactor immune to meltdown.** **Page 6**

Cover: Researchers at South Pole launch balloon carrying ozone-measuring instruments. Photo by NSF's John T. Lynch

Letters 2

Concentrates

Business 7
Government 12
Science/Technology 15

The Departments

Books 34
ACS News 37
People 50
Newscripts 52

Business

Global consumption of alpha-olefins is expected to more than double to nearly 2.7 million metric tons in the year 2000, squeezing supply and spurring capacity additions. **Page 9**

Australia's giant liquefied natural gas project to be completed within year will launch the country as a major energy exporter. **Page 10**

Government

No links between Vietnam veterans' health and past exposure to herbicides in Vietnam were found in extensive new study by the Centers for Disease Control. **Page 13**

Fees for reviewing and processing pesticide registration applications will be implemented by EPA despite Congressional opposition. **Page 14**

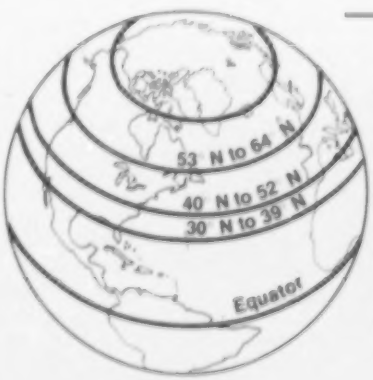
Education

Growing need for modernization and expansion is behind Institute of Paper Chemistry's decision to move to Atlanta by mid-1991. **Page 26**

Technology

In on-site analytical lab at Indianapolis 500 auto race, teams of chemists and technicians tested fuels and lubricants and examined auto parts for flaws. **Page 29**

New family of molecular sieves that are powerful deodorizers is developed by Union Carbide. **Page 30**



Science

Studies on ozone loss expand beyond Antarctica where chlorine from CFCs is proven culprit in ozone destruction as scientists find indications of perturbed chlorine chemistry in Arctic stratosphere. **Page 16**

Chemical & Engineering News

1155—16th St., N.W., Washington, D.C. 20036

Editor: Michael Heylin
Assistant Managing Editors: David M. Kiefer, James H. Krieger, Janice R. Long, Donald J. Soisson, William J. Storck. **News Editor:** Wilbert C. Lepkowski
Staff Editor: Ernest L. Carpenter
Senior Editors: New York: Earl V. Anderson, Stephen C. Stinson; Chicago: Joseph Haggin; Washington: Doron Dagani, Lois R. Ember, Rebecca L. Rawls, Pamela S. Zurer
Associate Editors: Stuart A. Borman, Mairin B. Brennan, Bette Hileman, Richard J. Seltzer
Service Departments Editor: Dolores Miner
Editing Services: Anne Riesberg (Head), Arlene Goldberg-Gist (Editorial Assistant), Patricia Oates (Administrative Assistant)

News Bureaus: New York: (212) 697-3223 Marc S. Reisch (Assistant Editor), Rachel Eskenazi (Administrative Assistant). Chicago: (312) 256-4143 Ward Worthy (Head). Houston: (713) 973-8161 Bruce F. Greek (Head). Washington: (202) 872-4495 David J. Hanson (Head). West Coast: (415) 653-3630 Rudy M. Baum (Head). **Foreign Bureau:** London: (01) 540-0414 Dermot A. O'Sullivan (Head), Patricia L. Layman (Associate Editor)
Graphics and Production: Leroy Corcoran (Manager). Alan Kahan (Art Director). Barbara Fryer (Production/Art Director). Linda Mattingly (Staff Artist). Diane Kelly (Costing). **Business Manager:** Arthur Poulos
Circulation Development: Cynthia G. Smith

ADVISORY BOARD: William J. Bailey, Jacqueline K. Barton, Ernest H. Drew, Harry G. Drickamer, A. Nicholas Filippello, Myron Foveaux, Vincent L. Gregory Jr., Adam Heller, John D. Holmfeld, Isabella Karle, Koji Nakanishi, Richard Nicholson, Howard A. Schneiderman, Ellen K. Silbergeld, Howard E. Simmons, Robert M. Simon, William P. Slichter

Published by
AMERICAN CHEMICAL SOCIETY
(202) 872-4600; TDD (202) 872-8733
John K Crum, Executive Director

PUBLISHING BOARD: Ned D. Heindel (*Chairman*); *Board of Directors Chairman:* Ernest L. Eliel; *President:* Gordon L. Nelson; John H. Nelson; Louis D. Quin; Jean'ne M. Shreeve; and Barbara G. Wood

© Copyright 1988, American Chemical Society

Subscription & Member Record Service: Send all new and renewal subscriptions with payments to: Controller, ACS, P.O. Box 28597, Central Station, Washington, D.C. 20005. Correspondence and telephone calls for changes of address, claims for missing issues, subscription service, status of records and accounts should be directed to: Manager, Membership & Subscription Services, ACS, P.O. Box 3337, Columbus, Ohio 43210; (614) 421-3776.

For changes of address, include both old and new addresses with ZIP code numbers and mailing label from a recent issue. Allow four weeks for change to become effective. Claims for missing numbers will not be allowed if loss was due to failure of notice of change of address to be received in the time specified; if claim is dated (a) North America: more than 90 days beyond issue date, (b) all other foreign: more than one year beyond issue date, or if the reason given is "missing from files."

Subscription Rates 1988. Printed editions: nonmembers U.S. 1 yr. $49, 2 yr. $83, outside U.S. 1 yr. $75, 2 yr. $135. Air freight rates available on request. Rates above do not apply to nonmember subscribers in Japan, who must enter subscription orders with Maruzen Co. Ltd., 3-10 Nihonbashi 2-chome, Chuo-ku, Tokyo 103, Japan. Tel: (03) 272-7211. Single copies: Current $7.00. Rates for back issues and volumes are available from Microforms & Back Issues Office, ACS, 1155—16th St., N.W., Washington, D.C. 20036. Back and current issues available on microfilm and microfiche. Rates on request from Microform Program, ACS.

Chemical & Engineering News (ISSN 0009-2347) is published weekly except for the last week in December by the American Chemical Society at 1155—16th St., N.W., Washington, D.C. 20036. Second-class postage paid at Washington, D.C., and additional mailing offices. POSTMASTER: Send address changes to Chemical & Engineering News, Membership & Subscription Services, P.O. Box 3337, Columbus, Ohio 43210. ACS assumes no responsibility for the statements and opinions advanced by the contributors to its publications.

Advertising Management
CENTCOM LTD.
(For list of offices see page 51)

LETTERS

Plastic handguns

SIR: Statements in the letter by Jack Jacox (C&EN, April 18, page 2) demand correction. He is apparently unaware of plastic handgun prototypes in existence in which the firing chamber and barrel are lined with carbon-fiber-reinforced high-impact ceramics. These guns have so little metal that they will not trip an airport metal detector. They will also be far cheaper to manufacture than machined metal weapons, so that national defense units have a legitimate interest.

For these reasons, it seems vital that strict controls be enacted to keep them out of the hands of terrorists—perhaps an impossible task.

Charles L. [illegible]esque
[illegible]sell, Pa.

Highly trained specialists

SIR: I scarcely blanched at the letter by Miles H. Robinson (C&EN, April 11, page 5), his remarks concerning "the shortsightedness of highly trained specialists" notwithstanding. He presumably intended to exclude broadly trained physicians such as himself from that categorization.

A problem did arise in my mind though, concerning his castigating the specialists' lack of vision with respect to the long-term impact of nuclear energy effects on biological systems. Without having, himself, the training of a specialist to judge it, he has no difficulty in rejecting technological solutions to waste containment. Has he considered the potential hazards of climatic change due to the higher global temperatures resulting from the greenhouse effect? Does his training enable him to judge the impact of economic and societal upsets on biological systems? Are such upsets less real than the effect of ionizing radiation?

New technologies must be poured over for risk possibilities, but not in isolation, as if existing methods were risk free. For example, what safer alternates are there to the use of nuclear energy, not only including alternate sources, but a shortfall scenario? What is the total impact on society within the range of possibilities?

Finally, Robinson chides us specialists for blaming the acceptance problems of nuclear energy on a public that is ignorant and uninformed compared to the "objective unemotional scholarly scientist." I believe the acceptance problems for new technology in general are due to a partially informed public. This is due in no small part to the lack of public relations and public affairs expertise of specialists such as ourselves, compared to the advocates of no change and status quo when it comes to issues related to the economic emergence of the have-nots of our world.

I can't avoid adding that I hope he remains so appreciative of the intuitive wisdom of the public as attention continues to turn to the exploding problem of affordable health care.

William S. Durrell
Chesterfield, Va.

Stereotypes of women

SIR: Upon receiving your detergent issue (C&EN, Jan. 25, page 21), we had some laughs in my lab about the absurd portrayals of the affinity between women and soap. It was refreshing to see a woman scientist on the cover for a change, even if the circumstances were disheartenigly stereotypical. The cosmetics issue (C&EN, April 4, page 21), however, is blatantly, repugnantly sexist. Once again there are women on the cover, but this time there is not even a pretense of their being scientists, or indeed anything more than objects.

First, depictions of women on the cover and in the magazine should acknowledge their diverse accomplishments, not focus on narrowly conceived notions of what women are and can do. Ads showing women should not suddenly pop out of the woodwork for an occasional woman-oriented issue. In the March 21 and 28 issues of C&EN, nine pictures of men and one picture of a woman appeared in the ads. The April 4 issue contained one picture of a man in an ad (for database search software), and seven pictures of women in ads (all for hair and skin care products).

Second, since products in the cosmetics and toiletries industry today actually

Correction

• May 2, page 8: Inadvertently omitted from the list of newly elected members of the National Academy of Sciences who are chemists or work in chemically related areas were Carl Frieden, professor and interim head of biological chemistry, Washington University; and John K. Hulm, staff member and director of corporate research and R&D planning, Westinghouse Research Laboratories, Pittsburgh

Demand for Alpha-Olefins Forecast To Double by Year 2000

Rapidly growing markets and shrinking supply is sparking capacity expansion plans in U.S. and abroad, as well as attracting new producers

Fast-growing end uses and capacity under strain: That's the recipe for a building spree. One of the most recent examples is alpha-olefins, the family of linear, one-double-bond olefins of various chain lengths, that serve markets ranging from comonomers for polyethylene to feedstocks for detergent surfactants.

Worldwide consumption of alpha-olefins is expected to more than double from 800,000 metric tons in 1986 to nearly 1.7 million metric tons in the year 2000, according to a new study by Colin A. Houston & Associates, Mamaroneck, N.Y.-based consultants.

With that kind of growth anticipated, producers Shell, Ethyl, and Chevron have launched major expansions in the U.S. and Western Europe. Ethyl is expected to announce soon a new 140,000 metric-ton-per-year plant, likely to be completed by the early 1990s, at its major plant site at Feluy, Belgium. Japanese capacity will more than double when Idemitsu enters the market with a new plant due on stream in early 1989. And Eastern European producers are planning or building alpha-olefin capacity—Czechoslovakia a 100,000 metric-ton-per-year plant, and the Soviet Union a 75,000 metric-ton-per-year unit, both slated to be on stream by 1991. And Shell is planning further debottlenecking of its facilities in the early 1990s.

End uses are almost completely determined by chain length. The light cuts, C_6 to C_8, have found solid markets as comonomers in making linear low-density polyethylene and high-density polyethylene. These end uses have been growing at about 25% per year, with the result that 1-hexene is in the tightest supply worldwide.

The importance of the comonomer market will continue to grow, predicts the Houston study. "Polyolefin comonomers accounted for just over 40% of total alpha-olefin consumption in 1986, and this will grow to 55% in 1995," says Ed Tarnell, director of special projects at Houston. "Use of alpha-olefins exploded with the development of linear low-density polyethylene in the 1970s. Exceptional growth will continue over the next decade."

However, he adds, consumption patterns for individual alpha-olefins, in particular, 1-butene, 1-hexene, and 1-octene, will shift according to regional supply availability and the impact of 4-methyl 1-pentene, a branched-chain olefin made by the catalytic dimerization of propylene, currently produced only by British Petroleum in the U.K. and Mitsui Petrochemical in Japan.

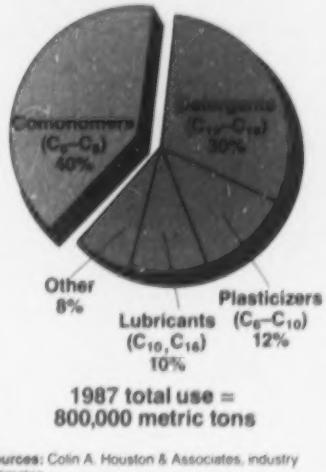
The heavier compounds, C_{14} to C_{18}, have markets in detergents, lubricating oils, and a variety of other products. For C_{16}, in particular, new markets are growing rapidly, putting pressure on supply of that particular set of compounds. Lube-oil additives are one fast-growing outlet, and paper sizings have been developed based on C_{16} alpha-olefins.

Some of that range also winds up in detergents, as alpha-olefin sulfonate. In Europe, the sulfonates have made very limited inroads. They are used for specialty formulations—baby shampoos, for example. The market in Western Europe is small, only about 3000 to 4000 metric tons per year.

On the other hand, Japanese producers have enthusiastically adopted alpha-olefin sulfonates for household detergents, replacing other surfactants. Similarly, there is strong development in these compounds in India, with a market currently at about 3000 to 4000 metric tons per year but predicted to grow within a few years to perhaps 30,000 metric tons. And the same fast-growth situation holds in South Korea.

The alpha-olefin sulfonates have found a place in Southeast Asia, says Shell's René Carlotti, business manager for detergents, higher olefins, and plasticizers at Shell International Chemical in London, because of the different washing conditions. The materials are particularly suited for toilet soaps and household soaps used under cold-water conditions. In Europe, where washwater would be warmer, different surfactants are needed.

Comonomers are biggest market for alpha-olefins



1987 total use = 800,000 metric tons

Sources: Colin A. Houston & Associates, industry estimates

In between the light cuts for comonomers and, to a lesser extent, plasticizers, and the heavier cuts, for detergents and other uses such as lube-oil additives, is the middle range. The hot "new" market there is for the C_{10} molecules for polyalpha-olefins, used in synthetic motor oils. These compounds have been around for a number of years, and have seen only slow development the past few years. Last year, however, the use of synthetic motor oils really started to grow, in part because of a move by marketers away from the purely synthetic product to blends, which offer improved performance without the full cost of the synthetic formulation.

The sudden growth probably has surprised the synthetic lubricant marketers; it certainly has surprised olefin suppliers. Says Carlotti: "We originally didn't plan to separate C_{10} from our production. Nobody expected a demand for it. But now the growth is there for polyalpha-olefins, and people are believing in the development."

Houston's study points out that increasing alpha-olefin capacity will mean a greater availability of 1-decene, for synthetic lubricants, which in turn will boost that market. At present, the only commercial producers of polyalpha-olefins are located in North America, and tight 1-decene supplies have limited production and exports. However, new polyalpha-olefin capacity is expected in Western Europe and Japan by 1990, and in East-bloc countries by 1995.

Although some of the markets overlap at the edges of each of these cuts of alpha-olefins, basically there are specific sets of end uses for specific chain lengths. One of the major problems with the alpha-olefins business is that, although one can modify the distribution of the chain lengths, no process does away with any of them. If one or two are produced, all of them are produced, demand or not.

Each company's process tries to tackle this problem of chain-length distribution in its own way. For example, Ethyl says that, because its alpha-olefins plant is integrated with its primary alcohol plant and with the peaking technologies employed in the olefins plant, the carbon number distribution can vary toward the peaks desired. The company can, it says, peak its production toward the light, middle, or heavy end of the spectrum and within limits can peak individual carbon numbers, depending on demand of the marketplace. Shell, with its SHOP process, can recycle unwanted or unsold alpha-olefins to produce other olefins for detergent intermediates.

The answer to dealing with cuts that are in plentiful supply, in a time of tight supplies otherwise, lies in a philosophy of flexibility. Says an Ethyl executive: "We have built process flexibility into our Pasadena (Tex.) plant and will add more, which will allow us to produce those carbon numbers the marketplace demands and in the volumes required."

Ethyl has long stressed its flexibility in the merchant market. It claims to be the largest supplier of alpha-olefins in the world, with nearly 60% of the merchant market. Ethyl's strong dependence on the merchant market is unusual, points out the Houston study, because almost half the world's alpha-olefin production is used captively. For example, Shell, the largest producer, uses more than half its output to make oxo-alcohols. Ethyl, however, uses less than 10% captively, primarily for lube-oil additives and alkyldimethylamines.

Patricia Layman, London

Capacity for alpha-olefins to rise sharply by 1991

Thousands of metric tons per year	Current	Expansion	Completion date
U.S.			
Chevron	125	125	1990
Ethyl	400	55	1988
Shell	340	240	1989
U.K.			
Shell	220	50	1989
JAPAN			
Idemitsu	—	50	1989
Mitsubishi	35	—	—
CZECHOSLOVAKIA	—	100	1991
U.S.S.R.	—	75	1990
TOTAL	**1120**	**695**	

Note: Capacity for C_6 to C_{18} compounds. **Sources:** Colin A. Houston & Associates, industry estimates

Australia's huge LNG project nears finish

Within a year, construction of Australia's North West Shelf Project (NWSP) will be finished, and the Australians will begin shipping liquefied natural gas to Japan. This LNG shipment will mark the conclusion of what is said to be the largest chemical processing construction project in the world today. In addition to providing the domestic energy resource for most of Australia, NWSP will launch Australia as a major energy exporter.

The origins of NWSP go back to 1963, when a small petroleum company, Woodside Petroleum Ltd., obtained exploration permits to search for oil offshore in Northwest Australia. Woodside formed a joint exploration venture with Burmah Oil, Shell, British Petroleum, and Calasiatic, and drilled 13 wells between 1964 and 1972. In 1971-72 major gas fields were found in the North Rankin, Goodwyn, and Angel fields of the Dampier Sub-Basin off the North West Shelf of Australia.

Changes in the partnership occurred in the 1970s when the character of the resource was established. At present, NWSP is owned jointly by Woodside (50%), Australia Pty. (16⅔%), California Asiatic Oil Co. (Chevron) (16⅔%), Shell Development (Australia) Pty. (8⅓%), and Hematite Petroleum Pty. (BHP) (8⅓%).

So far, 74 exploration wells and 12 field appraisal wells have been drilled. The result has been the discovery of proven recoverable hydrocarbons currently estimated to be 30.1 trillion standard cubic feet of natural gas and 542 million barrels of condensate in eight reservoirs of the Dampier Sub-Basin and the Browse Basin.

To an economy that had depended, in large measure, on imported oil for energy, the discovery of gas off the North West Shelf proved to be a boon, even if it did require some abrupt changes of technology to accommodate it. Development of the resource was helped along by the energy crises of the 1970s, which also prompted eventual development of the offshore gas fields of